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“Step Out From the Old to the New”

IS 11855 (2004): Guidelines for Design and Use of Different Types of Rubber Seals for Hydraulic Gates [WRD 12: Hydraulic Gates and Valves]

“ज्ञान से एक नये भारत का निर्माण”

Satyanaaranay Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartṛhari—Nītiśatakam

“Knowledge is such a treasure which cannot be stolen”



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भारतीय मानक

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सीलों के डिजाइन एवं उपयोग के दिशानिर्देश

(पहला पुनरीक्षण)

Indian Standard

GUIDELINES FOR DESIGN AND USE OF
DIFFERENT TYPES OF RUBBER SEALS FOR
HYDRAULIC GATES

(*First Revision*)

ICS 93.160

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Hydraulic Gates and Valves Sectional Committee had been approved by the Water Resources Division Council.

Dams/Barrages are built for storage/diversion of water for irrigation or generation of electric power. In concrete dams, tunnels/spillways, head regulator of hydel channels, forebay intake structure, by-pass channels and draft tube of power house, the flow of water is controlled with the help of hydraulic gates.

To prevent flow of water past a closed gate, seals are provided either on the gate or on the metal frame in the gate slot. Rubber is the most commonly used material for seals, as it is elastic, deforms readily and regains its original shape on removal of load.

This standard was first published in 1986. In this revision specification part has been separated and covered in IS 15466 : 2004 'Rubber seals for hydraulic gates—Specification'.

There is no ISO standard on the subject. This standard has been prepared based on indigenous manufacturers data/practices prevalent in the field in India.

The composition of the Committee responsible for the formulation of this standard is given at Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

GUIDELINES FOR DESIGN AND USE OF DIFFERENT TYPES OF RUBBER SEALS FOR HYDRAULIC GATES

(First Revision)

1 SCOPE

This standard lays down guidelines for use of different types of rubber seals used for all common types of hydraulic gates.

2 GENERAL

2.1 Rubber seals should be moulded only, ensuring a homogeneous cross-section. These may also be cladded by fluorocarbon. Specification for different types of seal are covered in a separate Indian Standard which is under preparation.

2.2 On the hollow bulb seals, a core of rubber stock may be used in the bulb at the splice.

2.3 Corner seals should be fully moulded. Details of the corner seals are given in a separate Indian Standard which is under preparation.

3 USES

3.1 Angle Shaped Seals

The sealing effect is obtained partly due to initial interference with the embedded sealing plate and partly due to the deflection under load. This type of seal is used on gates on the crests of dams and weirs. The assembly details with angle shaped seal is shown in Fig. 1.

3.2 Flat/Wedge Seals

These seals are used generally as bottom seals for all types of gates and they seal against the bottom sealing plate. They require high initial compression loading for proper seating. The assembly details with wedge type of seal is shown in Fig. 2.

3.3 Music Note Seal

The arrangements of music note seal over the seal base plate are shown in Fig. 3.

3.3.1 The initial interference of music note type seal should vary from 2 to 5 mm depending upon the requirement and type of its installation at the discretion of the designer.

3.3.2 The music note seal is generally recommended to be used on gates operated for head up to 30 m.

3.3.3 The hollow bulb music note seal is recommended for gates operated at low head up to 15 m.

3.3.4 A solid bulb music note seal is recommended for gates operated at medium head, that is at a head of water exceeding 15 m but less than 30 m.

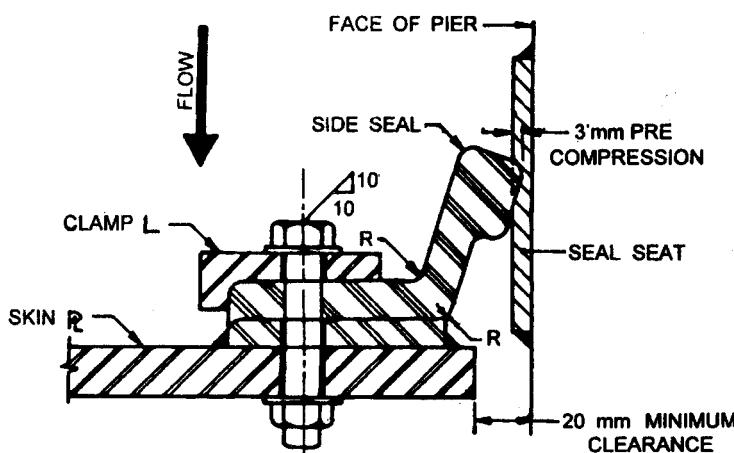


FIG. 1 ASSEMBLY DETAILS WITH ANGLE SHAPED SEAL

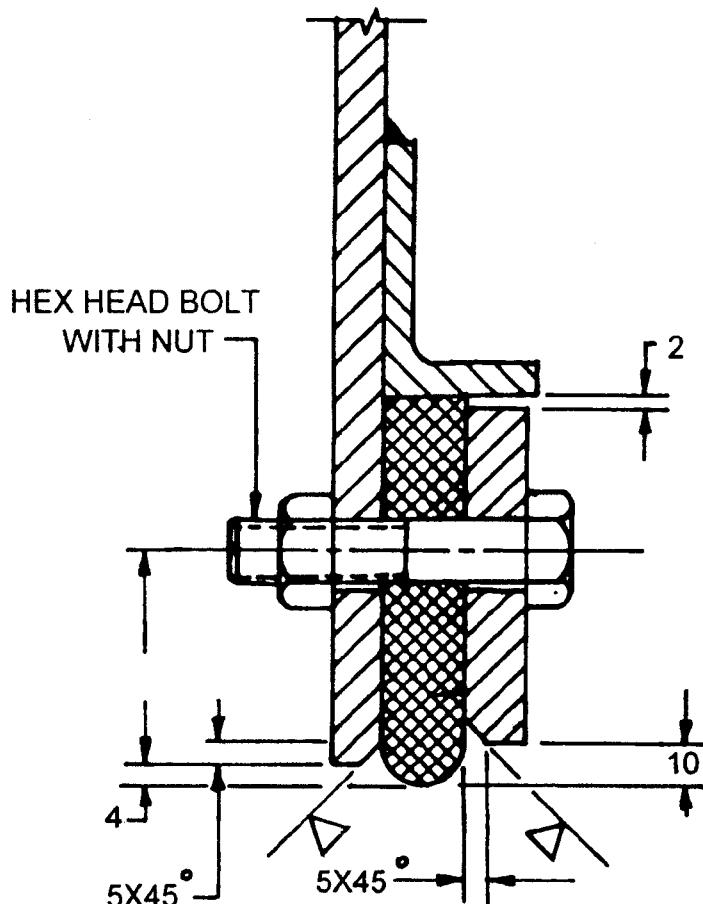


FIG. 2 ASSEMBLY DETAILS WITH WEDGE TYPE SEAL

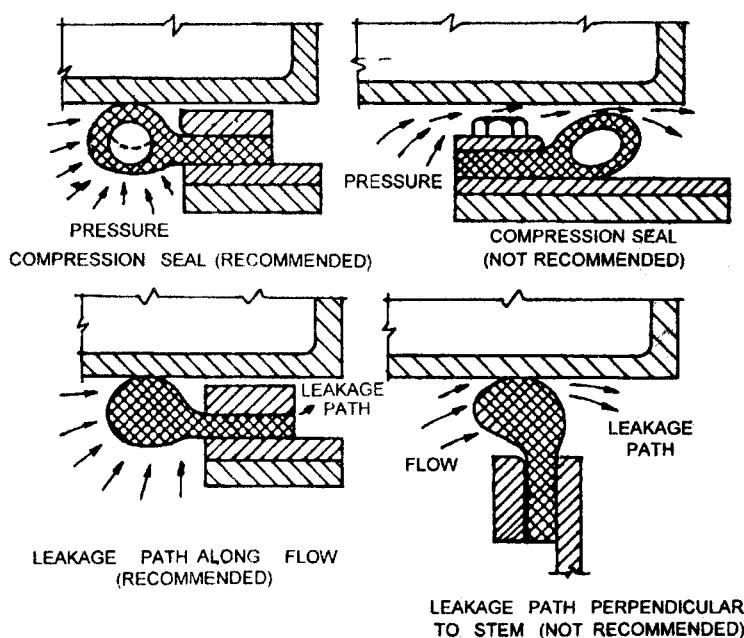
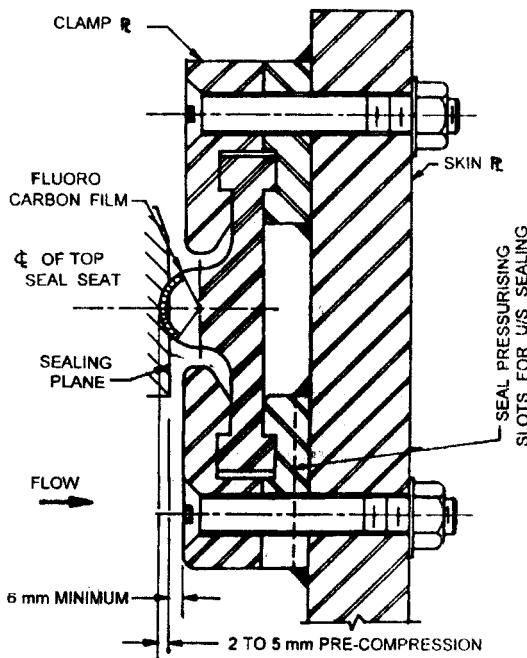


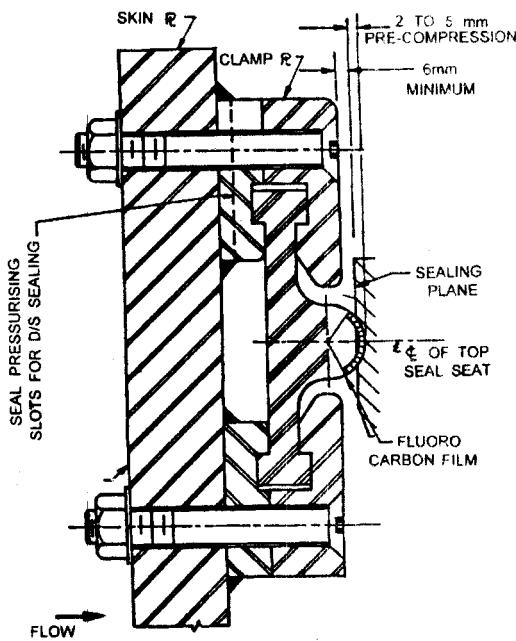
FIG. 3 ARRANGEMENT OF SEALS OVER SEAL BASE PLATE

3.4 Double Stem or Caisson Seal

This type of seal is used for heads exceeding 30 m. The sealing will be obtained due to interference of water pressure between the seal seat and the seal itself as well as behind the seal in the space between the seal base plates. The arrangement of double stem seal over the seal base is shown in Fig. 4.



4A Assembly Details with Double Stem Seal (Upstream Sealing)



4B Assembly Details with Double Stem Seal (Downstream Sealing)

FIG. 4 DOUBLE STEM SEAL

3.4.1 The sealing bulb should project 6 mm beyond the face of the clamps. The initial interference of 2 to 5 mm between the plane of the sealing bulb and sealing face of the seal seat is usually provided.

3.4.2 These seals may be used as top, bottom and side seals either by using them with water pressure acting behind them which is withdrawn before the gate is moved to reduce/eliminate friction load or they may be used cladded with fluorocarbon film to achieve the same purpose. On heavy gates such seals may be well used as bottom seals where enough mechanical compression becomes available to make a good seal.

3.5 Double Bulb Seal

These type of seals are used where the gate is required to seal from either upstream or downstream side. These are normally used for installation such as lock gates.

4 FORCE ON SEALS DUE TO INTERFERENCE AND DEFLECTION

An idea of the forces likely to develop in the seal due to compression on account of interference and due to deflection is indicated in the curve shown in Fig. 5 for the guidance of designer.

5 FRICTION OF SEALS

5.1 The following values of coefficient of friction for seals may be adopted in general (unless otherwise determined by tests) in the design of gates and associated equipment.

Sl No.	Type of Seal (2)	Coefficient of Friction	
		Static (3)	Dynamic (4)
(1)	i) Rubber seal on stainless steel	1.5	1.2
	ii) Seals with fluorocarbon cladding on stainless steel	0.2	0.15

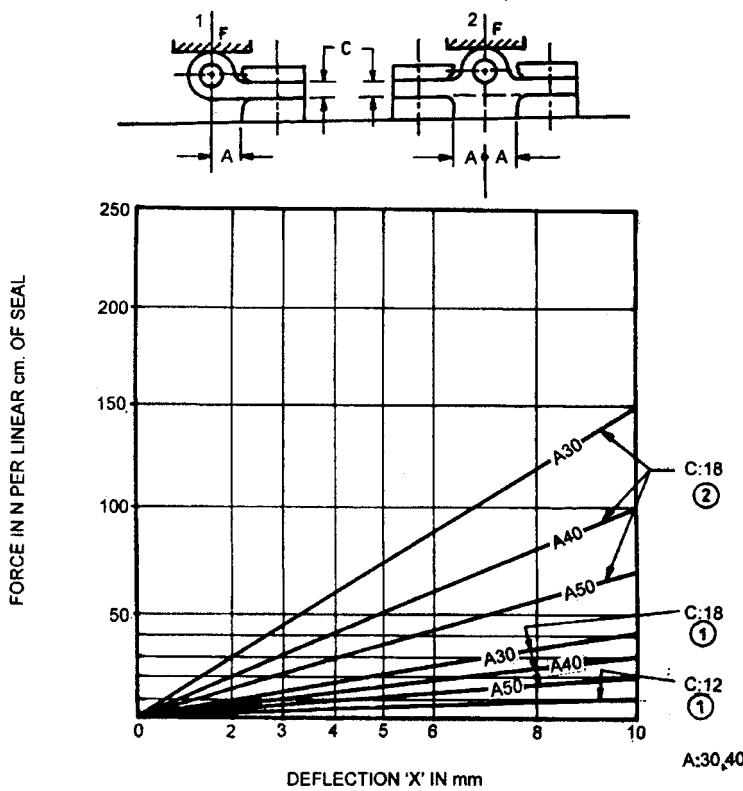
5.2 The area of loading to determine the frictional load on the seals should be as under :

- Caisson seal* — The area ($2A \times \text{length}$) acted upon by water pressure behind the seal (see Fig. 5).
- Music note seal* — The projected area ($A \times \text{length}$) of the seal up to the centre of the bulb (see Fig. 5).

6 SPLICES

6.1 As far as practicable only vulcanized splices should be provided.

6.2 All splices in all rubber seals should be wherever practical on a 45° bevel as related to the thickness (not the width) of the seal.



NOTES

- 1 For seals of other dimensions, values of force may be interpolated/extrapolated.
- 2 Applicable for both solid and hollow bulb.
- 3 Deflection X corresponds to pre-compression envisaged.

FIG. 5 FORCE DEVELOPED DUE TO DEFLECTION

6.3 The splice position should avoid bolt hole in web portion.

6.4 Cladded seals should not be bevelled. They should be square cut at right angle.

6.5 Field splices, if not vulcanized should never be made on a bevel. Pieces should be cut at a 90° and given an interference of not less than 2 mm so that when they are butted tightly (one to the other) they will not climb.

7 TRANSPORTATION, HANDLING AND STORAGE OF SEALS

7.1 Adequate care should be taken for proper packing of the rubber seals in black polythene rolls

to avoid damage in transport and storage.

7.2 The seals should not be allowed to come in contact with any sharp edged or pointed objects or any abrasive surface that might cut or tear the rubber.

7.3 Direct sunlight, oxygen and ozone affects the physical properties of rubber and causes it to age more quickly. Seals, therefore, should be stored in a dark cool room in original packing.

7.4 It is suggested to leave the seals in the original packing, however, the seal should be unrolled and kept on a flat surface at least 48 h before installing it.

ANNEX A
(Foreword)
COMMITTEE COMPOSITION

Hydraulic Gates and Valves Sectional Committee, WRD 12

<i>Organization</i>	<i>Representative(s)</i>
In personal capacity (2047, Pocket-2, Sector-D, Vasant Kunj, New Delhi)	SHRI N. VISHVANATHAN (Chairman)
Bhakra Beas Management Board, Punjab	DEPUTY CHIEF ENGINEER EXECUTIVE ENGINEER (<i>Alternate</i>)
Bharat Heavy Electricals Ltd. Bhopal	SHRI A. S. SRIVASTAVA SHRI S. R. RATHORE (<i>Alternate</i>)
Central Electricity Authority, New Delhi	SHRI R. K. RUSTAGI
Central Water & Power Research Station, Pune	SHRI R. M. SINNARKAR SHRI S. L. PATIL (<i>Alternate</i>)
Central Water Commission, New Delhi	DIRECTOR, GATES (E & NE) DIRECTOR (GATES-NW & S) (<i>Alternate</i>)
Himachal Pradesh State Electricity Board, Sunder Nagar, H.P.	CHIEF ENGINEER (DESIGN) SHRI D. K. VAIDYARA (<i>Alternate</i>)
Irrigation Department, Maharashtra, Nashik	SHRI V. C. SHELKE
Irrigation Research Institute, Roorkee	CHIEF ENGINEER (DESIGN) SUPERINTENDING ENGINEER (<i>Alternate</i>)
National Hydroelectric Power Corporation Ltd, Faridabad	SHRI G. S. SHARMA SHRI A. K. ROY (<i>Alternate</i>)
Orissa Construction Corporation Ltd, Bhubaneshwar	DIRECTOR (MECHANICAL) SENIOR MANAGER (DESIGN) (<i>Alternate</i>)
Texmaco Ltd, Kolkata	SHRI S. R. SINHA SHRI UDAYAN BANERJEE (<i>Alternate</i>)
Triveni Structural Ltd, Allahabad	SHRI J. P. MISHRA SHRI B. P. SINGH (<i>Alternate</i>)
Tungabhadra Steel Products Ltd, Karnataka	SHRI HUSSAIN BIN ALI SHRI Y. S. CHANDRASHEKARAJAH (<i>Alternate</i>)
Water Resources Development Training Centre, Roorkee BIS Directorate General	SHRI (PROF) GOPAL CHAUHAN SHRI S. S. SETHI, Director & Head (WRD) [Representing Director General (<i>Ex-officio</i>)]

Member Secretary
SHRIMATI ROSY DHAWAN
 Joint Director (WRD), BIS

Bureau of Indian Standards

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Amendments Issued Since Publication

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